

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

YAMAGATA

Atty. Ref.: 3553-2

Serial No. 09/391,399

Group: 2862

Filed: September 8, 1999

Examiner: T. Fetzner

For: MAGNETIC RESONANCE IMAGING APPARATUS

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October 21, 2002

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

RESPONSE

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In response to the Office Action dated 06/21/2002, reconsideration of this application is respectfully requested in view of the following remarks.

The Examiner is thanked for rescinding all prior grounds of rejection.

The new rejection of claims 1-5 under 35 U.S.C. §102 as allegedly anticipated by Green '957 is respectfully traversed.

The applicant's invention is directed to diagnostic magnetic resonance imaging wherein the three dimensional position of a region of interest inside a patient is determined and the patient is then physically moved in three dimensions so that such region of interest is repositioned to lie substantially at the center of either the static or

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gradient magnetic field of the MRI system. In short, applicant's invention permits quick positioning of a desired region of treatment or diagnosis at the center of the gradient magnetic field and static magnetic field to enable the acquisition of highly precise high quality images with reduced image distortion, better uniformity, fewer fat artifacts, etc.

By contrast, the Green reference is primarily directed to a radiotherapy machine -- which happens to be used in conjunction with MRI. However, as Green specifically teaches, the MRI system is merely used so as to provide an image of the region being treated by the radiotherapy system somewhere within the field of view of the MRI system. Indeed, Green goes out of his way to note that the MRI aspect of the system is of only very low quality. For example, see column 3, beginning at line 57:

"A feature of the invention is that the magnetic field derived from the excitation coils of the magnetic resonance imaging system is relatively low, sufficient to provide only the minimum necessary spatial resolution and sensitivity for determining whether the radiotherapy beam is incident on the desired region to be treated..."

Among other things, claim 1 requires the patient couch controller to move the patient couch, based on provided three dimensional position information of the region of patient interest, so that the region of interest is repositioned at three dimensions substantially either at the center of the static magnetic field or at the center of the gradient magnetic field. The Green reference itself does not mention anything at all about the center of the static magnetic field or the center of the gradient magnetic field. The Examiner alleges that it does (e.g., see numbered paragraph 20 starting at page 5, of the Office Action). However, the quotation marks used by the Examiner appear to be related

to the applicant's claim language rather than to any portion of the Green reference. In particular, the undersigned can find no such quotation in Green at any location -- including column 1, lines 31-37 and column 9, lines 34-40 or column 9, lines 1-11 or column 10, lines 13-26 or column 20, lines 60-68 or column 7, lines 6-17 -- all cited by the Examiner as alleged support for this proposition. The Examiner appears to confuse the ISO center of the Green radiotherapy machine with the center of the static or gradient magnetic fields of the MRI apparatus. It should be noted that Green specifically defines the "ISO" center of his apparatus as being the ISO center of the radiotherapy machine whereat the treatment beam intersects the rotational axis of the treatment beam (e.g., see column 1, lines 33-37). If the Green reference at any place ever even references the center of the static magnetic field or the center of the gradient magnetic field of the MRI apparatus, the Examiner is respectfully requested to point it out to the undersigned.

In addition, of course, Green does not teach any form of rough pre-image before creating a more time consuming diagnostic image.

In view of these fundamental deficiencies of the Green reference, it is not believed necessary to discuss further deficiencies with respect to claims 1-5. It is clearly impossible for the Green reference anticipate any of these claims.

The rejection of claims 6-9 under 35 U.S.C. §103 as allegedly being made "obvious" over the same single Green '957 patent is also respectfully traversed.

These claims are directed to method for performing MRI diagnosis. The Examiner alleges that Green is similarly directed. The undersigned respectfully disagrees. As earlier mentioned, the very low quality MRI included as an adjunct to the radiotherapy machine of Green '957 is clearly not for the purpose of producing MRI diagnostic images. Instead, Green merely teaches the use of a low resolution simplistic MRI system as an adjunct to the radiotherapy machine so that the MRI field of view includes somewhere therewithin the region being treated by the radio therapy unit such that the radiotherapy treatment can be followed in real time, etc.

The Examiner's allegation that Green somehow teaches moving the patient couch so that a region of interest of the patient approximately coincides with the center of k-space is not understood in several respects. First of all, the applicant has not claimed any such feature. Secondly, k-space does not have any real relationship to the subject matter that is claimed -- nor to any relevant aspect of Green. Indeed, the "center of k-space" is simply part of the spatial frequency domain where the lower spatial frequencies are encoded. As the Examiner should appreciate, every part of k-space actually relates to every part of the field of view. Accordingly, there is not correspondence between the center of k-space and the geometrical center of a static or gradient magnetic field in an MRI system.

In any event, contrary to the Examiner's allegations, the undersigned can find nothing anywhere in the Green reference relating at all to k-space -- let alone the center of k-space.

As with claims 1-5, claims 6-9 all require that the patient region of interest be moved to substantially coincide in three dimensions with the center of the static magnetic field or the center of the gradient magnetic field. As already noted, Green totally lacks any teaching or suggestion of such positioning.

Accordingly, it is not believed necessary at this time to discuss any of the further deficiencies of Green with respect to the other features of these claims. For reasons already noted, Green is believed to be a basically irrelevant reference.

The rejection of claims 10-12 under 35 U.S.C. §103 as allegedly being made "obvious" based on Green '957 in view of Wilk '857 is also respectfully traversed.

Claim 10 depends from claim 9. The fundamental deficiencies of Green with respect to parent claim 9 have already been noted above.

Claims 11-12 require generating MR images of a patient while located at a first position using a first high speed positioning scan MR data acquisition pulse sequence, locating and designating a patient region of interest position within such images followed by generating three position difference data between the thus designated position of the patient region of interest in the pre-diagnostic imaging images and an optimum MR

imaging position -- further followed by automatically re-positioning the region of interest in three dimensions away from the first, now designated, position to an optimum MR imaging position using such position difference data and, finally, generating diagnostic MRI data after the patient is repositioned to the optimum MR imaging position using now a second diagnostic MRI data acquisition pulse sequence different than the first sequence so as to provide diagnostic images having improved precession and quality with reduced image distortion, non-uniformities and fat artifacts.

For reasons that have already been noted, Green is fundamentally deficient in any such teaching or suggestion.

Indeed, the Examiner now admits that Green lacks directly teaching the step of "obtaining positional information from a position sensor representing a three dimensional position for the region of interest". To supply this admitted deficiency, the Examiner now relies upon Wilk '857 at column 7, lines 10-21. However, as was already noted in applicant's remarks of September 27, 2001, the passages cited by the Examiner merely teach that a treatment electromagnetic energy (not any radiation from the MRI viewing system) is re-directed to follow the changed location of the target region in accordance with new positional coordinants of that target region as it moves within the field of view of the MRI system. That is, the MRI system is actually just providing the doctor with real time "inside" body images so that the treatment radiation can be caused to follow movements of the target region (e.g., caused by patient breathing, heart beating,

involuntary reflexive movements, etc.). The automatic tracking and re-positioning described at column 7 deals with re-positioning the patient so that the target area remains subject to the desired electromagnetic treatment being supplied to the target area -- not with respect to any movement whatsoever of the MRI system or its field of view or, more importantly, the center of the MRI system static or gradient magnetic fields. Indeed, the entire teaching of Wilk '857 is silent with respect to location of the centers of the static or gradient magnetic fields of the MRI system.

In short, even if Wilk is combined with Green, one is still left with primarily a radiotherapy machine that happens to include an auxiliary MRI system for providing rough and quick "real time" images to help insure that the radiotherapy is being applied to the desired region of the patient. So long as the desired region of the patient is located somewhere within the field of view of the auxiliary MRI system, this objective will be realized. There is nothing in either of these references that in any way suggests moving the patient so that a designated position in the patient coincides with the center of the static or gradient magnetic field of the MRI system.

Accordingly, it is not believed necessary at this time to discuss the further deficiencies of both these references with respect to the applicant's claims.

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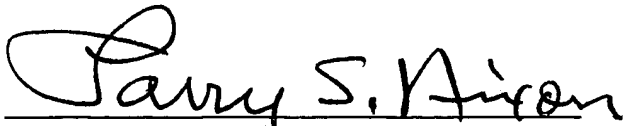
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This application is therefore believed to be in fully allowable condition and a formal Notice to that effect is respectfully solicited.

Respectfully submitted,

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